SHIPBOARD/TACTICAL NOWCAST/FORECAST SYSTEM

Daniel N Fox
Naval Research Lab Code 7323
Stennis Space Center, MS 39529-5004
Phone: 601-688-5588 Fax: 601-688-4759 Email: fox@nrlssc.navy.mil
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LONG-TERM GOALS

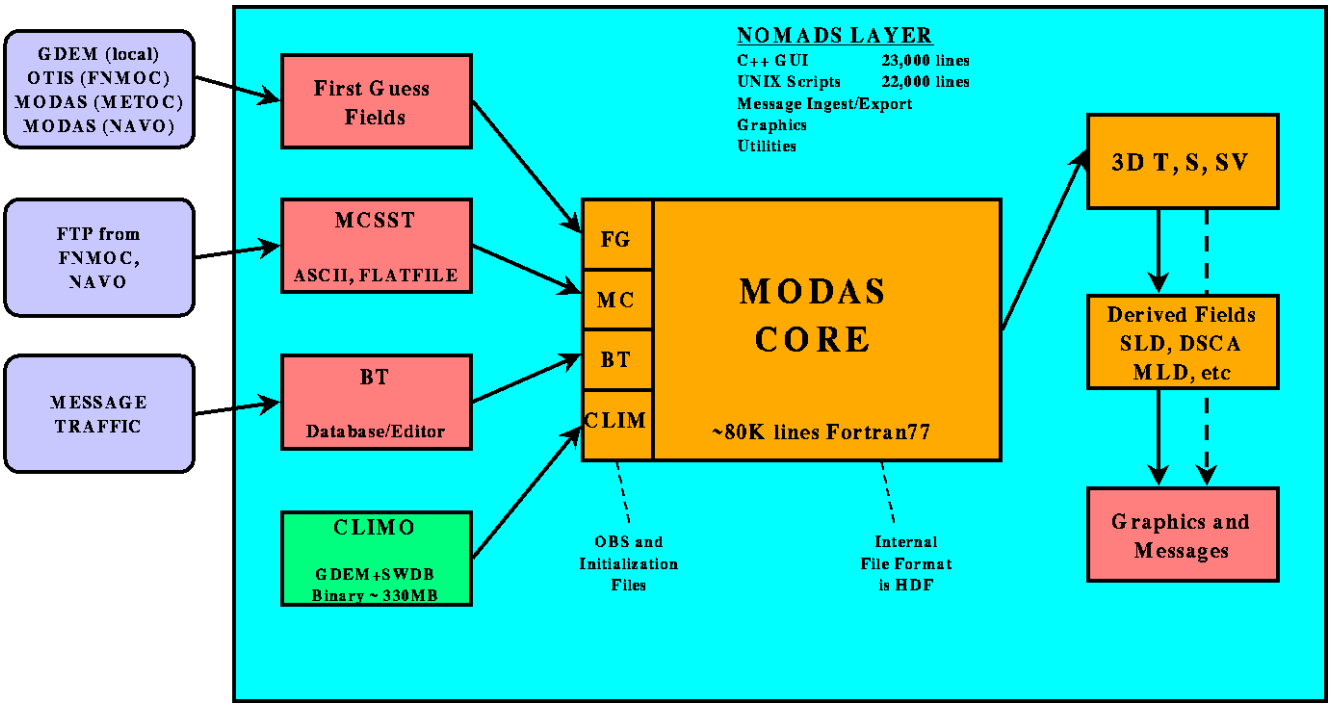
The development of limited-area, open-boundary, nowcast/forecast systems that have a stand-alone, shipboard capability and which can be applied around the globe, especially in shallow coastal waters.

OBJECTIVES

The transition of a workstation-based system for producing optimum regional and tactical scale ocean nowcasts and forecasts to related 6.4 projects.

APPROACH

Adapt, develop, and evaluate the components necessary for a limited-area, coastal nowcast/forecast system and integrate these components into a demonstration system for evaluation, comparison, and transition. This system is called NOMADS, for NRL Ocean Models and Assimilation Demonstration System, and is outlined below. The key module in this version of NOMADS is the Modular Ocean Data Assimilation System (MODAS), a set of programs and scripts for performing optimum interpolation.



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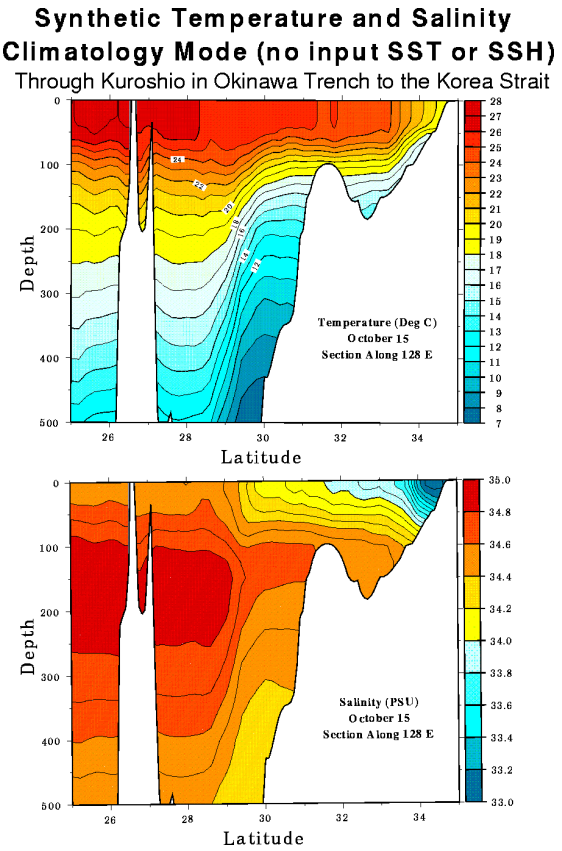
The figure above outlines MODAS version 1.6 and the NOMADS infrastructure which supports it. In order to perform an optimum interpolation, a first guess background field is needed. In this version, this field is provided by climatology (GDEM, augmented by a special shallow water database) or by a prior analysis (either a Fleet Numerical OTIS analysis or a MODAS analysis performed locally or transmitted from the Naval Oceanographic Office). The algorithms use sea surface temperature and BT profile data, which are often transmitted to the user from a central site or extracted from Naval message traffic. The first guess fields and in situ data may be processed manually on-demand, or via Unix "cron" jobs which automatically run at pre-defined times. A typical analysis takes a few minutes to perform on a Sun SPARC20-class computer, and the output consists of three-dimensional volumes of temperature and salinity, and derived quantities such as sound speed. These output fields may be displayed graphically, converted to common formats (such as GIF) to simplify their use in presentations and web pages, and converted to standard Naval formats such as EOF compacted field messages (for 3D fields) and OTH-G OVERLAY2 (for any 2D contour plots of quantities like mixed layer depth, temperature at a user-selected depth, deep sound channel axis and many others).

WORK COMPLETED

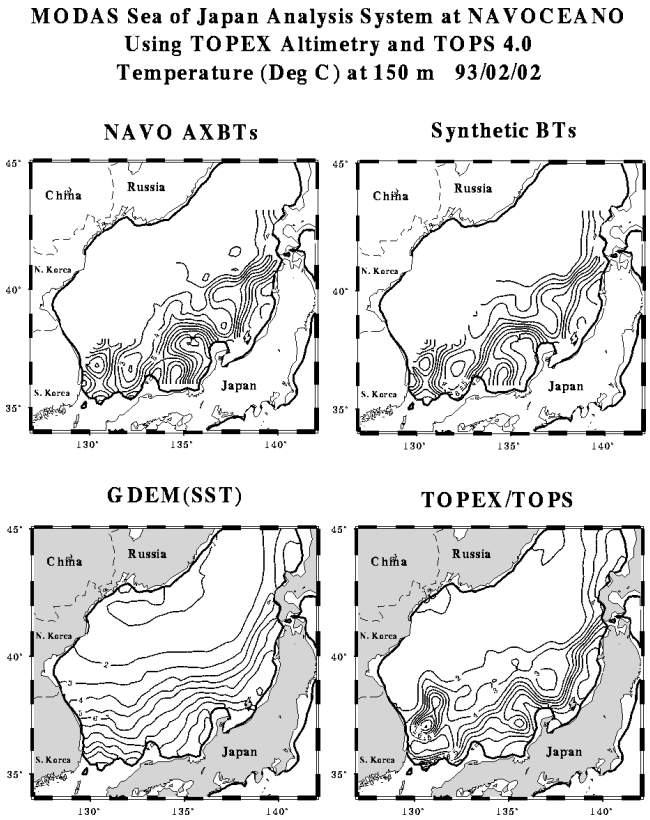
Transitioned MODAS 1.0 to the 6.4 Shipboard/Tactical project, which received OAML acceptance for that version. Transitioned (to 6.4) upgrades to MODAS for shallow water support in selected areas (Sea of Japan, Yellow Sea, Taiwan Straits). The figure at right represents a slice through the MODAS climatology, showing the seemless transition from deep to shallow water.



Developed databases and algorithms to allow real-time satellite altimetry to be converted into synthetic profiles and transitioned a test of this approach for the Sea of Japan to NAVOCEANO where it represented the first use of real-time satellite altimetry in an ocean analysis system. This approach was later revised and expanded in a related project (6.2 Relocatable Shipboard Coastal Modeling System) to develop MODAS 2.0, which is discussed in more detail in the report for that project. MODAS 2.0 represents a significant advance in ocean nowcast/forecast systems, especially through its use of real time satellite data (both altimetry and sea surface temperatures) to provide accurate first-guess fields (temperature and salinity volumes) over almost the entire globe.

RESULTS

The figure at right shows an example of the Sea of Japan analysis system running at NAVOCEANO using real-time TOPEX altimetry and coupled to TOPS. This system was used as a test-bed for algorithms and databases that would form the core of how MODAS 2.0 would use altimetry. In this testbed, only short arcs of altimetry were available which required special processing that is not needed in MODAS 2.0 (which has the full global altimeter tracks).



The synthetic BT algorithms which have been developed over the years by this project are used here to convert the altimeter heights into simulated BT profiles which are then combined with 'real' profiles using optimum interpolation. Another approach tested in this project involved assimilating (via nudging) these synthetic profiles into a Princeton Ocean Model of the Sea of Japan.

IMPACT/APPLICATIONS

MODAS has proven to be a valuable tool for creating ocean nowcasts, both at the Navy's regional METOC centers, where it is used multiple times daily in areas across the globe, and for research projects at NRL. For example, components of MODAS are used in the processing of altimetry to generate grids of sea-surface height, and it was used in a DARPA simulation exercise to generate realistic depictions of the Sea of Japan.

TRANSITIONS

MODAS 1.6 was transitioned to the related 6.4 Shipboard project, where it was deployed to four Navy Meteorology and Oceanography Centers (METOC's) where the earlier version of MODAS was being run. The code was also submitted to the TESS/NC group at NRL/Stennis as a place-holder pending completion of MODAS 2.0 for inclusion in the next generation TESS.

RELATED PROJECTS

This was the final year of this project, whose goals and tasks have now been taken over by the related 6.2 Relocatable Shipboard Coastal Modeling System project. This project is tightly integrated with the 6.4 Shipboard project and the 6.2 NRL ODA (Ocean Data Assimilation, formerly DART) project.

REFERENCES